

Information Science and Technology Seminar Speaker Series



Dr. Lav R. Varshney
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Chef Watson and the Mathematical Limits of Creativity

Wednesday, October 21, 2015

3:00 - 4:00 PM

TA-3, Bldg. 1690, Room 102 (CNLS Conference Room)

Abstract: Creativity is defined to be the generation of an idea or artifact judged to be novel and also to be appropriate, useful, or valuable by a knowledgeable social group, and is oft-said to be the pinnacle of intelligence. Data-driven computational systems, which produce creative artifacts in several domains, are now being demonstrated and deployed. Chef Watson is a particular of computational creativity for culinary recipes, which we describe in detail, where the basic operations are to intelligently sample from the domain, rank according to predictors of novelty and quality, and select.

There are multifarious designs for computational creativity and to engineering systems theorists, this zoo of possibilities raises the natural question: are there fundamental limits to creativity? Here we develop a model of creative domains with combinatorial artifacts constructed from components and study fundamental tradeoffs between quality and novelty. Novelty is measured using the information-theoretic functional, Bayesian surprise, which is the relative entropy between the empirical distribution of an inspiration set and that set updated with the new artifact. Quality is measured using ermutation-invariant functions of the components comprising the new artifact. There is a fundamental tradeoff between novelty and quality, determined by the maturity of the creative domain. As the maturity of a creative domain increases, there is a phase transition from artifacts that are both novel and high-quality, to ones where a tradeoff between the two must be made. We also discuss mathematical models of discovery, which expands the combinatorial space for creativity.

Biography: Lav R. Varshney is an assistant professor in the Department of Electrical and Computer Engineering, a research assistant professor in the Coordinated Science Laboratory, and a research affiliate in the Beckman Institute for Advanced Science and Technology, all at the University of Illinois at Urbana-Champaign. He was a research staff member at the IBM Thomas J. Watson Research Center, Yorktown Heights, NY from 2010 until 2013. His research interests include information theory, sociotechnical systems, data analytics, computational creativity, automated discovery, and the history and social studies of science. Dr. Varshney was a finalist for the 2014 Bell Labs Prize and his work appears in the anthology, *The Best Writing on Mathematics 2014*. His award-winning masters and doctoral theses at the Massachusetts Institute of Technology pushed information theory to consider new dimensions. He has received many best paper awards, including at the 2015 Data for Good Exchange (D4GX). He previously conceptualized IBM's Chef Watson system for culinary computational creativity and led its initial design, development, and deployment, garnering much worldwide attention.

For more information contact the technical host Frank Alexander fja@lanl.gov, 665-4518.

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